Buyer groups, preferential treatment through key account management, and cartel stability

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20 October 2015

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Abstract

This paper examines why some customers may want to create a buyer group (BG), and why key account management (KAM) may be a tool for the seller to deal with BG members separately from customers that remain outside the BG. We find that both actions are related and explain each other. The implementation of a KAM program makes it advantageous for some customers to belong to a BG, eliminating the inherent instability that would otherwise plague the BG. Simultaneously the formation of a BG leads the seller to resort to a KAM approach so as to segment the market and charge higher prices to customers remaining outside the group. The seller's commitment problem is then highlighted.

Key words: Buyer groups, key account management, market segmentation, cartel stability, commitment problem

JEL Classification: L20, L21

1. Introduction

In many economic sectors there is a tendency to configure purchasing groups as a means to achieve greater bargaining power vis-a-vis suppliers. Examples of this practice include the horizontal integration of cable television operators for the acquisition of programs (Chipty and Snyder, 1999) and of small drugstores and hospitals for the purchase of pharmaceutical products (Ellison and Snyder, 2001).

Suppliers, on the other hand, tend to assign strategic importance to the accounts of large buyers. Compared to small accounts, the larger accounts are dealt with in a more personalized and bilateral fashion. In the jargon of the marketing literature, sellers develop key account management (KAM) programs with top sales executives, creating a separate sales force or even a separate corporate division (Johnston and Marshall, 2003). Such strategies are commonplace, and are traditionally justified in terms of the importance of personalized treatment in retaining major customers in the face of competition (Cappon, 2001; Johnston and Marshall, 2003).

In this paper, we examine the interaction between a seller with market power and its customers when some of them form a buyer group (BG) and the seller deals differently with this large customer compared to the small customers that remain outside the BG. In particular, we investigate the rationale for creating a BG by some of the customers, and the rationale that leads the seller to introduce a KAM approach to segment the market configured by the BG members from that of non-members. Indeed, market segmentation explains the formation of a BG and vice versa. It is true that BG members gain leverage against the seller, but if there is no market segmentation and the seller treats all customers – either inside or outside the BG – equally, then independent customers profit more from the formation of the group than customers grouped together. As a consequence, each customer has an incentive to freeride, and the BG unravels.

But it is also true that, whenever there is a BG, the seller wants to segment the market and deal with grouped customers separately from small customers. If there is no market segmentation, the BG customers together can obtain leverage against the seller by restricting their demand. Market segmentation therefore has two main advantages for the seller: first, it allows higher prices to be set for independent customers; second, a KAM program as a selling strategy leads to a more efficient relationship with BG participants.

Interestingly, the fact that the seller reacts to the formation of a BG with a KAM approach encourages the creation of the group itself. In fact, our main contribution in this paper is to provide the rationale for the formation of a BG by some customers, and to relate it to the implementation of a KAM selling strategy. We find that both decisions are closely linked, not only in the rather obvious sense of sellers creating KAM in response to the existence of a BG of consumers, but also in the opposite sense of a BG emerging and surviving because prospective participants anticipate being treated differently from customers remaining outside the group. We show that, without market segmentation, buyers are confronted by the standard freerider problem of collective action (Olson, 1965; Hardin, 1971). However, when the seller is expected to introduce a KAM program as a reaction to the formation of a BG, the freerider problem disappears.[1] Nonetheless, the seller faces a commitment problem in this context: ex-post, once the BG has been created, profits increase if a KAM policy is implemented to segment the

[1] If the only selling procedure is a supply-function rule (but not a KAM program), the strategic interaction between buyers in our model is similar to that of firms facing an oligopoly. Salant et al. (1983) were the first to note that, in a Cournot oligopolistic setting, a cartel is not profitable unless a large number of firms enter the cartel; moreover, outsiders obtain larger profits than members of the cartel, rendering the cartel unstable. A body of literature initiated by Bloch (1996) has analyzed in detail the severity of the stability problem in the process of cartel formation (see Bloch, 2005, for a sound survey of this topic).

market, whereas ex-ante, profits would be larger if implementing a KAM program could be avoided, since the BG would not emerge in such a case.

To explore why a subset of customers might want to form a BG, and why the seller would develop a KAM policy as a reaction, we consider an industry with a monopolistic seller and a continuum of homogeneous buyers. In this set up, we assume the seller has minimal marketing tools consisting of a supply-function rule.[2] We also assume that independent customers behave as price takers, since they are sufficiently small to have a negligible impact on market prices. We then analyze the incentives to create a BG through the strategic impact of the demand of its members on the market price, and the seller's strategic reaction of offering bilateral contracts — the KAM strategy — to the BG members.[3]

The impact of bilateral deals and contracts on market competition has long been addressed in the industrial organization literature. For potential entrants into an industry, for instance, it has been argued that contracts between incumbent firms and buyers can act as an entry barrier (Innes and Sexton, 1994; Segal and Whinston, 2000). Beyond this, our results suggest that, even in the absence of potential entrants, bilateral contracts may be considered by the seller and by some of its existing customers for their transactions.

In comparing the relative merits of different sales modalities in a range of circumstances, a number of studies are of particular relevance to our research. First, when demand is uncertain, competing sellers are better off announcing supply functions rather than posting prices or quantities (Klemperer and Meyer, 1989). Second, with

[2] A posted price is not optimal when demand is uncertain and when it cannot be responded to with an instantaneous adjustment of prices (Klemperer and Meyer, 1989). Moreover, the supply function rule may represent the decision rule imposed by top management on lower-level management, as would be realistic in a firm with different levels of sales management and in which top managers transmit rules of behavior that are useful under different contingencies but cannot obtain immediate feedback about the actual state of demand (Basu, 1993, p. 142).

[3] The implementation of the KAM program is assumed to be costless and implies the creation of a special sales force that is not obliged to follow general pricing guidelines but is instead allowed to deal with customers grouped together.

asymmetric information and heterogeneous customers, an auction is more profitable for the seller than a posted price (Wang, 1993). Third, under asymmetric information, bilateral bargaining is preferable for the seller to posted-price selling in a dynamic context (Wang, 1995). Finally, Ausubel et al. (2014) show the incentives of large buyers in multi-unit auctions to reduce demand and shade bids differently across units, which leads to inefficiencies both in uniform-price and pay-as-bid auctions, and that the latter often outperform the former in terms of efficiency and expected revenues.

The remainder of the paper is organized as follows. Section 2 describes the industry model used, namely, one consisting of a single producer that sells a homogeneous good to a continuum of buyers of equal size. Section 3 analyzes industry performance when all customers act independently and the seller submits a supply schedule. Section 4 examines market outcome when some customers form a BG and act strategically by submitting an aggregate demand function, with the seller continuing to submit a supply function rule as the selling method. It is demonstrated that, in this context, independent customers profit more than BG members from the existence of a BG and, as a consequence, the BG is not stable. Section 5 analyzes the market outcome when the seller can offer a deal to BG customers different to that offered to independent customers. In this case, we find that seller's profits increase with market segmentation, and customers outside the BG are worse off than BG members, with the consequence that the group becomes stable. Finally, Section 6 concludes the paper.

2. The model

Consider an industry consisting of a monopolist that sells a homogeneous product to a continuum of n identical customers. A subset of these customers may be associated in a

BG, whereas the remaining customers continue to purchase on an independent basis. If some customers are grouped together, the seller is aware both of this and of the BG's size. Let k, $0 \le k \le n$, be the cardinal of customers that have decided to join the BG; thus, the BG's relative size, $s \equiv \frac{k}{n}$, can vary from 0 (in which case the seller may act as a pure monopoly) to 1 (and then there is a bilateral monopoly). Bearing in mind the expected demand function,[4] we assume until Section 5 that the seller's strategy is to set the linear supply function

$$S(p) = \theta\, p\,, \tag{1}$$

where p denotes the price of the good, and parameter θ, $\theta > 0$, measures the slope of the supply function chosen by the seller. In Section 5 we will assume that the seller can segment the market and, in addition to a linear supply function for independent customers as reflected in Eq. (1), can also offer personalized treatment — in the form of a KAM approach — to customers associated in a BG.

Each individual consumer i (whether or not a BG member) is assumed to have the quasi-linear utility function $U(q_i) = \left(1 - \frac{1}{2} q_i\right) q_i + w$, where q_i denotes the quantity consumed, and w stands for the numeraire. The consumer surplus therefore amounts to

$$U(q_i) - pq_i = \left(1 - \frac{1}{2} q_i\right) q_i - pq_i\,, \tag{2}$$

[4] As stated in the Introduction, we follow Klemperer and Meyer (1989) in using a supply function to represent the seller's pricing policy.

where *p* denotes the price of the good. On the other hand, the seller's production costs are assumed to be

$$C(q;\lambda) = \frac{\lambda}{2}q^2, \tag{3}$$

where λ, $\lambda > 0$, is a constant that measures the degree of convexity of the cost function.

Independent buyers are assumed to be price takers since they are small and so have no impact on market outcomes. They therefore demand the quantity that maximizes their consumer surplus, as given in Eq. (2). In contrast, a BG of relative size *s* announces an aggregate demand for its members that takes into account the impact of this demand on market price. Thus, the BG strategically chooses the slope of the per-BG member demand function. If there is a unique market-clearing price, the seller's production is given by its supply function at this equilibrium price, and buyers obtain the amount of product given by their demand schedule at that market-clearing price.

3. Market equilibrium: independent buyers

If all buyers purchase the product on an independent basis, the maximization of their consumer surplus, as reflected in Eq. (2), yields individual demand $D_i(p) = 1 - p$ for each one. Hence, the seller faces market demand

$$D(p) \equiv nD_i(p) = n(1-p) \tag{4}$$

and seeks to maximize profits, that is,

$$\max_{p} D(p)p - C(D(p)) = n(1-p)p - \tfrac{\lambda}{2}[n(1-p)]^2 . \tag{5}$$

The optimal price satisfies the first-order condition

$$\frac{\partial D(p)}{\partial p} p + D(p) - \frac{\partial C(\cdot)}{\partial D(p)} \frac{\partial D(p)}{\partial p} = 0 , \tag{6}$$

which, for our demand and cost functions, can be particularized as

$$1 + z - (2+z)p = 0 , \tag{7}$$

where parameter z is defined as $z \equiv \lambda n$, that is, as the product of the degree of convexity of the seller's cost function and the market size. Instead of setting the optimal posted price $p^{\mathrm{m}} = \frac{1+z}{2+z}$, where superscript m denotes a pure monopoly scenario, the seller can get the same profits by setting a supply function as in Eq. (1) that clears the market at the optimal monopoly price p^{m}. Taking Eq. (7) into account, the market-clearing condition $S(p) = D(p)$ yields the seller's optimal supply function

$$S(p) = \frac{n}{1+z} p , \tag{8}$$

which has slope $\theta^{\mathrm{m}} = \dfrac{n}{1+z}$. All the equilibrium values are obtained directly and can be summarized in Lemma 1.

Lemma 1. *When all customers buy on an independent basis, then:*

(i) *Each customer consumes the quantity* $q_i^{\mathrm{m}} = \dfrac{1}{2+z}$ *at price* $p^{\mathrm{m}} = \dfrac{1+z}{2+z}$.

(ii) *Each customer obtains the consumer surplus* $CS_i^{\mathrm{m}} = \dfrac{1}{2(2+z)^2}$.

(iii) *The seller obtains the profit* $\pi^{\mathrm{m}} = \dfrac{n}{2(2+z)}$.

The equilibrium described in Lemma 1 is adopted as a benchmark when large, strategic buyers arise as a BG and the price of the good is the same for customers inside and outside the BG (as in Section 4), or when the seller uses a KAM program to deal with the BG members separately from the independent buyers (as in Section 5).

4. Market equilibrium: buyer group

Consider now the situation in which a subset of k customers, $0 \le k \le n$, forms a BG to purchase the good, while $n-k$ customers are left as independent buyers. As in Section 3, each small buyer has the demand function $D_i(p) = 1 - p$, and the seller has the supply function $S(p) = \theta p$. But this time there is a BG that simultaneously has the aggregate demand function $D_{BG}(p) = k\alpha(1-p)$, where subscript BG refers to the buyer group. The equilibrium price is thus determined by the market-clearing condition

$$D_{BG}(p) + (n-k)D_i(p) = S(p), \tag{9}$$

which, for our linear demand and supply functions, becomes $[n-k(1-\alpha)](1-p)=\theta p$ or, equivalently, $n[1-s(1-\alpha)](1-p)=\theta p$. The market clearing price is thus $p=\frac{n-k(1-\alpha)}{\theta+n-k(1-\alpha)}=\frac{n[1-s(1-\alpha)]}{\theta+n[1-s(1-\alpha)]}$.

When a BG exists, the BG and the seller simultaneously choose the slopes of their demand and supply functions, respectively. Therefore α, the slope of the per-BG member demand function, is chosen strategically to maximize the consumer surplus of the BG members, taking into account both the expected (non-strategic) behavior of the buyers outside the BG and the expected strategic behavior of the seller. In this scenario, the incentive of the BG to withdraw demand from market is reflected in the fact that $\alpha<1$. The seller, in turn, when deciding on the amount of product to place in the market, anticipates the monopsonistic behavior of the BG and accordingly adapts its supply-function schedule $S(p)$.

Below, we look for the optimal slope of the BG's demand for any given slope of the supply function, $\alpha=\Psi_{BG}(\theta)$, and the optimal slope of the seller's supply for any given slope of the BG's demand, $\theta=\Psi_S(\alpha)$, where subscript S refers to the seller. We then look for the slopes profile that constitutes a Nash equilibrium in slopes.

The residual supply faced by the BG at any price p, $RS(p)=S(p)-(n-k)D_i(p)$, is given by $RS(p)=(\theta+n-k)p-(n-k)$. Thus, the price that maximizes the consumer surplus of the BG members is the price that solves the problem

$$\max_p \left(1-\tfrac{RS(p)}{2k}\right)RS(p)-pRS(p)=\tfrac{1}{2k}(n+k-(\theta+n+k)p)\left[(\theta+n-k)p-(n-k)\right]. \qquad (10)$$

The corresponding first-order condition is given by

$$\frac{\partial RS(p)}{\partial p}\left(1-p-\frac{RS(p)}{k}\right)-RS(p)=\frac{1}{k}\left[n(\theta+n)-k^2-(\theta+n+k)(\theta+n-k)p\right]=0\,, \qquad (11)$$

yielding the optimal price $p^*=\frac{n(\theta+n)-k^2}{(\theta+n+k)(\theta+n-k)}=\frac{\frac{\theta}{n}+1-s^2}{\frac{\theta}{n}\left(\frac{\theta}{n}+2\right)+1-s^2}$. In order to maximize the consumer surplus of its members, the BG must choose an aggregate demand function that clears the market, $D_{BG}(p)=RS(p)$, at price p^*. This affords the aggregate demand function

$$D_{BG}(p^*)=k\left(1-\frac{k}{\theta+n}\right)(1-p^*)=ns\left(1-\frac{s}{\frac{\theta}{n}+1}\right)(1-p^*)\,. \qquad (12)$$

If the seller is expected to follow the supply function given by Eq. (1), and if the demand of independent buyers is $D_i(p)=1-p$, then the best response of the BG as a whole is to set the aggregate demand function given in Eq. (12), for which the optimal slope of the per-member demand function is given by

$$\alpha=\Psi_{BG}(\theta)=1-\frac{k}{\theta+n}=1-\frac{s}{\frac{\theta}{n}+1}\,. \qquad (13)$$

It can be noted from Eq. (13) that $0<\Psi_{BG}(\theta)<1$, i.e. the BG orders a smaller per-member quantity than non-BG members for a given market price. As a consequence, non-BG members freeride the BG and obtain a larger consumer surplus than BG members themselves.

In the presence of a BG, the demand the seller faces at any price p is given by

$$D(p) = D_{BG}(p) + (n-k)D_i(p) = (n-k+k\alpha)(1-p) \tag{14}$$

and, in order to choose the optimal linear supply function, the seller seeks to maximize profits by selecting a point in the residual demand and by choosing a supply function which equals demand at the optimal price, as in Eq. (8). The optimal price is then $p^* = \frac{1+\lambda(n-k+k\alpha)}{2+\lambda(n-k+k\alpha)} = \frac{1+z(1-s+s\alpha)}{2+z(1-s+s\alpha)}$, and the linear supply function that leads to this price has slope

$$\theta = \Psi_S(\alpha) = \frac{n-k+k\alpha}{1+\lambda(n-k+k\alpha)} = n\frac{1-s+s\alpha}{1+z(1-s+s\alpha)}. \tag{15}$$

From Eqs. (13) and (15) it follows that $\Psi'_{BG}(\theta) > 0$ and $\Psi'_S(\alpha) > 0$, i.e. both actions —the BG's behavior in choosing α and the seller's behavior in setting θ — are strategic complements (Bulow et al., 1985), as illustrated in Figure 1.

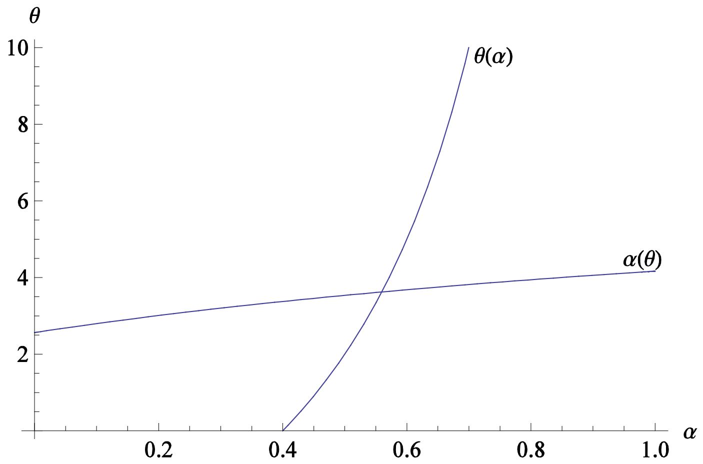

Figure 1. Reaction functions of the seller, $\theta(\alpha)$, and the buyer group, $\alpha(\theta)$, for z =1.4 and s=0.6.

The solution to Eqs. (13) and (15) yields the following proposition:

Proposition 1. *When a subset of customers forms a BG, the equilibrium is unique and is as follows:*

(i) *BG members choose* $\alpha^* = \frac{\sqrt{1-s^2}\sqrt{4(1+z)+z^2(1-s^2)}+z(1-s^2)-2(1+z)(1-s)}{2s(1+z)}$ *and the seller chooses* $\theta^* = n\frac{\sqrt{1-s^2}\sqrt{4(1+z)+z^2(1-s^2)}-z(1-s^2)}{2(1+z)}$.

(ii) *The larger the BG, the flatter the BG's demand function and the seller's supply function*.

Proof. See the Appendix.

Compared with Lemma 1, part (i) of Proposition 1 shows that the BG withdraws demand from the market, $\alpha^* < 1$, and that the seller reacts to the existence of a BG with a flatter supply function than when all customers buy independently, $\theta^* < \theta^{\mathrm{m}}$. The intuition regarding this result is as follows: the existence of a BG reduces aggregate demand, and this leads the seller to react by increasing price sensitivity to any increase in supply. Part (ii) of the lemma indicates that both these behaviors are exacerbated as the BG is enlarged.

Given the equilibrium behavior reflected in Lemma 1 and Proposition 1, it can immediately be concluded that the equilibrium quantity decreases in *k*, the number of customers that decide to create the BG. However, less evident is what happens to the equilibrium market price. Tedious algebraic manipulation shows that

$$p^* = \frac{1}{2}\left(1 + \lambda\sqrt{\frac{(n-k)(n+k)}{(2+\lambda n+\lambda k)(2+\lambda n-\lambda k)}}\right) = \frac{1}{2}\left(1 + z\sqrt{\frac{1-s^2}{4(1+z)+z^2(1-s^2)}}\right), \tag{16}$$

which allows us to conclude that $p^* < p^{\mathrm{m}}$ and $\frac{\partial p^*}{\partial s} < 0$. Hence, the equilibrium market price is lower whenever there is a BG, and decreases as the size of the BG increases. Figure 2, which illustrates market equilibrium with and without a BG, depicts aggregate demand and supply functions when there is a BG with outside customers acting individually (broken lines), and when all customers purchase on an independent basis (continuous lines).

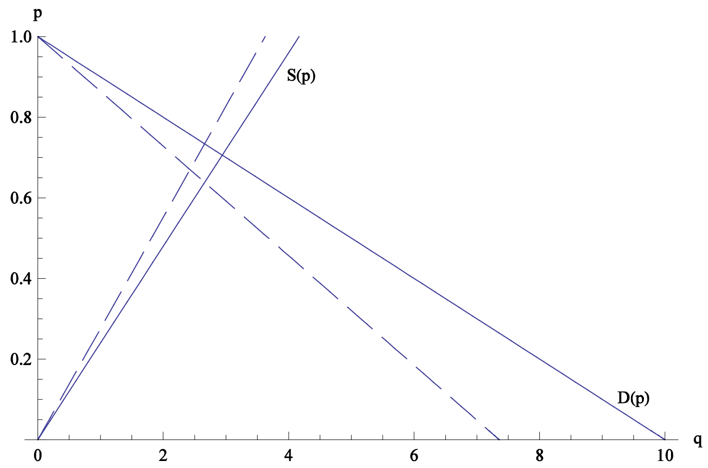

Figure 2. Market equilibrium when all customers act independently (continuous line) and when some of the customers form a buyer group (broken line) for *z*=1.4 and *s*=0.6.

The consumer surplus of the BG and non-BG members can now be compared. From their respective consumption levels in equilibrium, $q^*_{BG} = \alpha^*(1-p^*)$ and $q^{\mathrm{m}}_i = 1-p^*$, the consumer surplus obtained amounts to

$$CS_{BG} = \frac{\alpha^*(2-\alpha^*)(1-p^*)^2}{2} \tag{17}$$

for the BG members, and to

$$CS_i = \frac{(1-p^*)^2}{2} \tag{18}$$

for each customer outside the BG. From Eqs. (17) and (18) it follows that whenever there is a BG withdrawing demand from the market, non-BG members are better off than BG members. In Lemma 2 below we examine the impact of the BG's size on the consumer surplus of BG members, CS_{BG}, the consumer surplus of non-members, CS_i, and the seller's profit, π_S.

Lemma 2. *Given parameter z, if a BG of size s exists, then, in equilibrium, the consumer surplus of BG members, the consumer surplus of non-BG members, and the seller's profit are, respectively,*

$$CS_{BG}(s) = \frac{1-s^2}{[4(1+z)+z^2(1-s^2)](1-s^2)+[2+z(1-s^2)]\sqrt{1-s^2}\sqrt{4(1+z)+z^2(1-s^2)}},$$

$$CS_i(s) = \frac{1}{8}\left(1-z\sqrt{\frac{1-s^2}{4(1+z)+z^2(1-s^2)}}\right)^2, \text{ and } \pi_S(s) = \frac{n}{2}\sqrt{\frac{1-s^2}{4(1+z)+z^2(1-s^2)}}.$$

Proof. See the Appendix.

Lemma 2 allows for analysis of how the consumer surplus of BG members evolves with size *s* of the group. It is not difficult to see that this will increase as the BG grows, provided the BG is not too large. The seller's profit always falls as the size of the BG grows, and is, therefore, always lower than it would be in the absence of a BG, $\pi_S < \pi^{\mathrm{m}}$.

Proposition 2. *When a subset of customers forms a BG, the following holds:*

(i) *If $z > 1$, for BGs of a sufficiently small size as $s \in (0, \bar{s})$, being $0 < \bar{s} < 1$, their members are better off than if no BG would exist, $CS_{BG}(s) > CS_i^{\mathrm{m}}$. In particular, the size of the BG that maximizes the consumer surplus of its members amounts to*

$s^* = \left[\frac{z^2+z+2-2\sqrt{2z(1+z)}}{z(z-1)} \right]^{1/2}$. *Moreover,* $\frac{\partial s^*}{\partial z} > 0$. *For the remaining values of parameters z and s, the creation of a BG is not profitable for its members,* $s^* = 0$.

(ii) *BG members are always worse off than non-BG members,* $CS_{BG}(s) < CS_i(s)$.

(iii) *Seller profits are lower than when all customers buy independently,* $\pi_S(s) < \pi^m$, *and decrease as the size of the BG grows,* $\partial \pi_S(s) / \partial s < 0$.

Proof. See the Appendix ■

Part (i) of Proposition 2 establishes that a BG makes sense. If, given the total number of buyers *n*, the convexity of the seller's cost function satisfies $\lambda > 1/n$, then BG members may be better off (with a judiciously chosen BG size) than if they purchase on an independent basis, despite the fact that the seller reacts to the presence of a BG by reducing supply. Intuitively, when costs increase quickly, total production becomes smaller and it becomes crucial for customers to obtain a good market price through the formation of a BG.

Part (i) also shows that the optimal size of the BG, s^*, goes from 0 to 1 as parameter λ increases and only approaches 1 as $z \to \infty$ (see Figure 3). In other words, the BG never incorporates all buyers, since the seller can react by setting a flatter supply function as the BG grows in size. In addition, the BG grows as the seller's cost function becomes more convex (a larger λ), and/or there are more buyers in the market (a larger *n*).

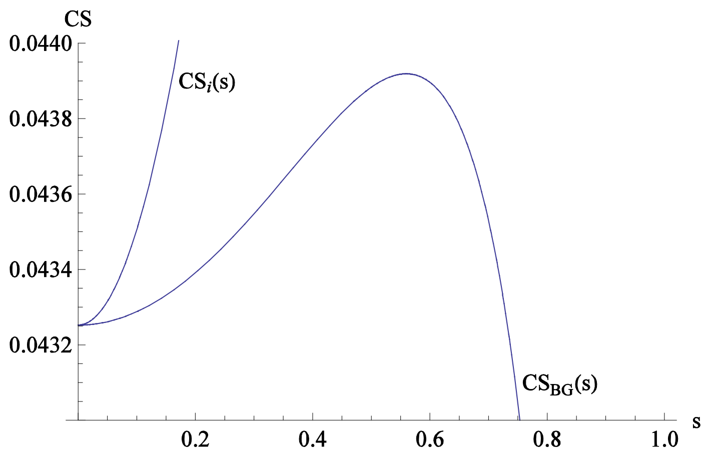

Figure 3. Optimal size of the buyer group as a function of parameter *z*.

Once we have seen that a BG makes sense, does it emerge? We can infer the answer from part (ii) of Proposition 2, which illustrates well-known results from the literature regarding collective action: a BG is unstable whenever outsiders are better off than insiders. Membership is therefore not profitable when there is no market segmentation, since all prospective participants prefer to freeride. Similar results are reported in the collusion and cartel literature. For instance, in their seminal analysis, Salant et al. (1983) demonstrated how non-participants in a cartel can freeride on the behavior of cartel participants and so obtain larger profits than the latter.

Finally, part (iii) of Proposition 2 is the consequence of the seller being unable to offset the profit reduction caused by the BG withholding demand. If a BG emerges, the seller should consider how to deal with its members. This opens the door for a KAM approach: the seller can try to eliminate the BG's ability to affect prices by segmenting the market. This is the possibility examined in Section 5, where we show that, in this case, the instability of the BG must be re-examined.

Figure 4 illustrates how the welfare of both BG members and non-BG members evolves with the size of the BG for a given value of parameter *z*, for which the formation of a BG will increase the consumer surpluses of both members and non-members with respect to the scenario depicted in Section 3, in which no BG emerged ($s^* = 0$).

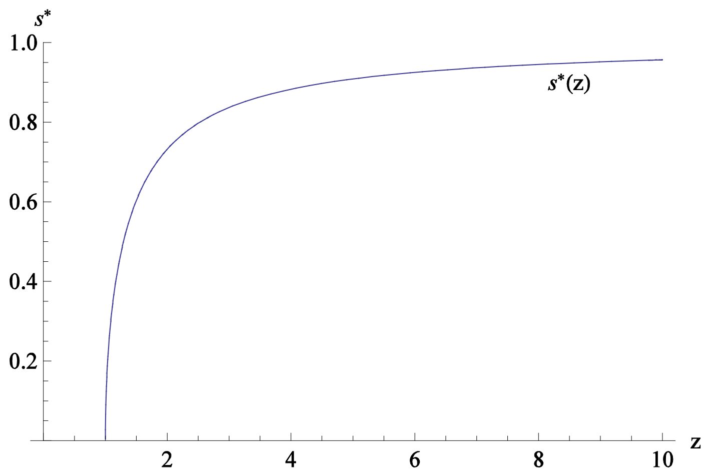

Figure 4. Consumer surplus for buyer group members, $CS_{BG}(s)$, and non-buyer group members, $CS_i(s)$, as a function of the size of the buyer group, for z=1.4, without a key account management program.

5. Market equilibrium: KAM approach

We now discuss market outcome when the seller uses a KAM program to deal with the BG, instead of a supply-schedule rule as in Section 4 above. The interaction between buyers and the seller we now consider has the following timing. First, a BG of size *s* is formed by some customers. Next, the seller offers a KAM program to customers in the BG to deal with them, being modeled that program as a personalized or bilateral contract for BG members. If there is agreement, the seller uses a supply function (as in Sections 3 and 4) to deal with customers outside the BG who purchase on an independent basis. In the event of disagreement between the seller and the BG members, the seller maintains with all buyers the relationship previously considered in

Section 4. For simplicity sake, two additional assumptions are made: first, the agreement between the seller and the BG is restricted to a unit price p_{BG} for its members; and second, the seller holds all the bargaining power in negotiations with BG members.

To make the analysis tractable, it is useful to assume linear prices in the bilateral deal between the seller and the BG, and also to assume that the seller can make a take-it-or-leave-it offer to the BG, implying that the proposed linear price is that which leads BG members to receive their reservation value (the consumer surplus obtained in the supply-demand function regime analyzed in Section 4). Finally, note that the implementation of the KAM program with non-BG members is not useful, because, since these buyers are price takers, a separate linear price does not increase profits.

In theory, direct dealing with customers in a BG through a KAM approach accrues two potential benefits for the seller. First, the relationship between the seller and the BG is more efficient, since the incentive to withhold demand disappears, and, as a consequence, the seller can potentially extract more profit from BG members. Second, since KAM prevents BG demand from being mixed with independent buyers demand, there is no impact of BG market power on transactions with independent customers. Hence, the agreement prejudices independent customers, who will experience a price increase.

Turning to the analysis of this set-up, we first look at the behavior of the seller when a BG of size *s* already exists and the seller introduces a KAM program. The seller offers a linear price p_{BG} to BG members, which leads to aggregate BG demand of $ns(1-p_{BG})$. When setting a supply function for independent buyers, the seller seeks, for the equilibrium price p_i, the demand function of independent buyers that maximizes profits. The seller therefore chooses a pair of prices (p_{BG}, p_i) that solves the problem

$$\left.\begin{array}{l}\max\limits_{(p_{BG},\,p_i)} n\left[s\,p_{BG}(1-p_{BG})+(1-s)\,p_i(1-p_i)-\dfrac{z}{2}\left[s(1-p_{BG})+(1-s)\,(1-p_i)\right]^2\right] \\ \\ \text{s.t}:\begin{cases}\dfrac{1}{2}(1-p_{BG})^2\geq CS_{BG}(s) \\ 0\leq p_i\leq 1\end{cases}\end{array}\right\}, \qquad (19)$$

where the first restriction is the participation constraint of the BG members, and the second restriction is a feasibility constraint.

It is useful to analyze the case in which the BG participation constraint affects the seller's problem as defined in (19). Given *z*, the value $\bar{s}$ defined in Proposition 2 is the BG size satisfying

$$CS_{BG}(0)=CS_{BG}(\bar{s})\,. \qquad (20)$$

The condition reflected in Eq. (20) allows us to define a BG of size *s*, $s\in(\bar{s},1]$, for which $CS_{BG}(0)>CS_{BG}(s)$ holds. In other words, if BG members reject the seller's offer and they interact as in Section 4, then a group of size greater than $\bar{s}$ would be worse off than if all the buyers acted independently. In the interval $(\bar{s},1]$, price $p_{BG}=p^{\mathrm{m}}$ is feasible (the participation constraint for the BG is not binding), and for independent buyers, the seller can set a supply function that leads to price $p_i=p^{\mathrm{m}}$. Therefore, through a KAM program, in the interval $(\bar{s},1]$, the seller can achieve the profits obtained by a monopolist facing non-strategic buyers as in Section 3. In contrast, in the interval $s\in(0,\bar{s}]$, the participation constraint for the BG is binding.

Lemma 3 characterizes the pair of prices (p_{BG}, p_i) that solves the problem stated in (19).

Lemma 3. *If* $z>1$ *and* $s \in (0, \bar{s}]$, *prices paid by BG customers and by independent customers are such that* $p_{BG} < p^{\mathrm{m}} < p_i$. *Thus,* $CS_{BG} > CS_i^{\mathrm{m}} > CS_i$.

Proof. See the Appendix.

Lemma 3 shows the striking result that, for BGs of size below $\bar{s}$, implementation of a KAM program leads the seller to squeeze out independent buyers. Figure 5 shows how BG membership affects the consumer surplus attained with KAM for different BG sizes.

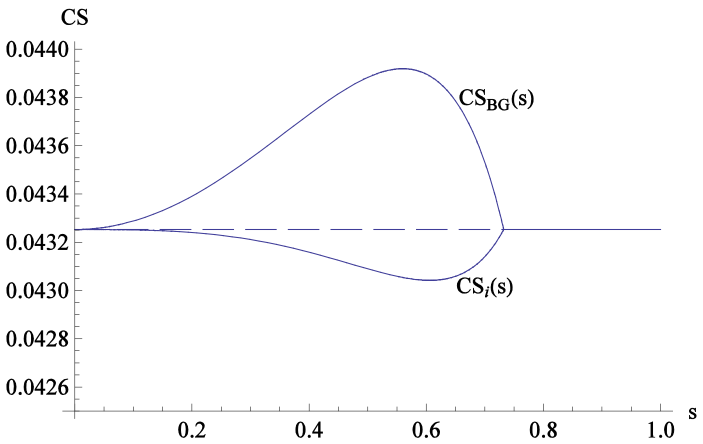

Figure 5. Consumer surplus for buyer group members, $CS_{BG}(s)$, and non-buyer group members, $CS_i(s)$, as a function of the size of the buyer group, for z=1.4, when a key account management program is implemented.

Given the market size *n*, as the BG grows, and as lower prices are offered to BG members (increasing their level of consumption), the seller must restrict supply to independent buyers in order to contain production costs.[5] When the BG reaches a size equal to or greater than $\bar{s}$, the participation constraint is no longer binding, and implementation of a KAM program leads to the same price level as that of emerging in a market with price-taking consumers.

5.1 Buyer group stability revisited

In Section 4 we showed that a BG is intrinsically unstable in the absence of a KAM selling strategy. Indeed, the formation of a BG is beneficial for members only if it does not exceed a maximum size, and the BG is, in any case unstable, since independent buyers profit more from its existence than BG members themselves. Lemma 3, however, suggests that if the good is sold through a KAM program to the BG customers, then independent customers may be squeezed out. Hence, if the prospective members of a BG anticipate that they will be treated differently from independent buyers, then they may have a strong incentive to join.

Thus, considering the case in which customers form a BG when they expect to be better off than if they acted independently, and also that BG membership may be restricted whenever an additional entrant reduces the per-capita consumer surplus of members, the following result holds.

Proposition 3. *If* $z>1$ *and the seller can introduce a KAM program, a BG of size* s^* *emerges and remains stable.*

[5] For some parameter values, independent customers are not even served at all.

A BG would not be created if its members did not expect personalized treatment from the seller in return. Different treatment solves the freerider problem that would otherwise plague the creation of a BG, and also stabilizes the BG by making the consumer surplus of its members greater than that of non-members (and no less than that of BG members in the absence of a KAM program). Furthermore, although, ex-post, it is in the seller's interest to introduce a KAM policy to deal with the BG, this never allows the seller to achieve profits as large as when a supply function is applied in the absence of a BG. Hence, no BG will emerge if the seller can commit to never resorting to KAM and can serve all customers on equal terms, as in Section 4. The formation of a BG thus depends both on the increasing surpluses of its members and on the pressure placed on the seller to implement a KAM policy.

6. Concluding remarks

Traditional wisdom has it that sellers implement a KAM approach so as to court large clients by offering better terms than to small or independent customers. However, we provide another rationale for introducing a KAM program. When dealing through a supply-schedule mechanism with customers grouped in a BG and with independent customers, the seller faces reduced demand as well as reduced profit when BG members are charged the same price as non-BG members. It is thus in the seller's interest to deal with the BG members by direct negotiation rather than through supply-function pricing, and to deal with any customer outside the BG in accordance with a supply function.

This market segmentation between KAM and non-KAM customers allows the seller to limit the impact of the BG on transactions between the seller and independent customers. By preventing customers within the BG from purchasing the product in competition with independent customers, the seller is able to exploit the latter more efficiently. In other words, bilateral bargaining with the BG enables the seller to partially make up for the negative impact of the BG on profits by increasing profits obtained from customers outside the BG. As a result, the consumer surplus of customers outside the BG is lower than it would be if no BG existed, and is also lower than that of BG customers. Thus, joining the BG is advantageous to buyers.

In sum, a BG, although initially unstable because of the threat of freeriders, has the potential to acquire stability when a KAM approach is implemented as a selling method and, therefore, price discrimination emerges. Since the seller is better off without a BG, i.e. when all transactions take place according to supply-demand functions, a BG would never emerge if the seller could avoid resorting to the KAM program. The formation of a BG thus depends on pressure on the seller to implement a KAM program with customers organized in a BG.

We restricted our analysis to incentives to form a single BG. An interesting avenue for future research is whether other coalitions of buyers could emerge and, more generally, what the final, endogenous organization of customers would be if more than one BG was possible. A further question of interest for future research is to understand what happens when buyers are retailers rather than end users of a good. Our findings suggest that, in this three-tiered situation of sellers, retailers and consumers, independent retailers would pay higher wholesale prices than grouped retailers, and would, accordingly, re-sell the product to their clients at higher retail prices. We thus conjecture that we could explain the frequently observed inefficiency of small, independent retailers in comparison with large retailers as the result of economies of scale in purchasing, not in production.

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Appendix

Proof of Proposition 1. (i) The fact that $\Psi_{BG}(0) = 1 - \frac{k}{n}$ is strictly positive whenever $k < 1$ leads any equilibrium to require fulfilment of the condition $\alpha > 1 - \frac{k}{n} > 0$. Consider the two functions $\theta = \Psi_{BG}^{-1}(\alpha)$ and $\theta \geq 0$. Any equilibrium is a value for α in the interval

$\left[1-\frac{k}{n},\, 1\right]$ for which $\Psi_S(\alpha)=\Psi_{BG}^{-1}(\alpha)$ holds. On one hand, note that at the corner, i.e. whenever $\alpha=1-\frac{k}{n}$, it holds that $\Psi_S(1-\frac{k}{n})>\Psi_{BG}^{-1}(1-\frac{k}{n})$. On the other hand, for $\alpha=1$, it holds that $\Psi_S(1)=\frac{n}{1+z}$ and $\Psi_{BG}^{-1}(1)\to\infty$. Since both the Ψ_{BG}^{-1} and Ψ_S functions are continuous, they must cross somewhere in the interval $\left[1-\frac{k}{n},\, 1\right]$. Hence, there must be at least one equilibrium point. However, the fact that

$$\frac{\partial\Psi_S(\alpha)}{\partial\alpha}=\frac{k}{[1+\lambda(n-k+k\alpha)]^2}<\frac{k}{(1-\alpha)^2}=\frac{\partial\Psi_{BG}^{-1}(\alpha)}{\partial\alpha} \tag{A1}$$

allows us to conclude that once both functions cross, they do not cross again. Therefore, the equilibrium is unique and is provided by the values α^* and θ^* obtained from solving Eqs. (13) and (15).

(ii) It immediately follows that $\frac{\partial\alpha^*}{\partial s}<0$ and $\frac{\partial\theta^*}{\partial s}<0$. ■

Proof of Lemma 2. From Proposition 1, we have the equilibrium values for the demand and supply slopes α^* and θ^*, respectively, as well as the equilibrium price p^* stated in Eq. (16). Inserting these values into Eqs. (17) and (18) we obtain the values for the consumer surplus of BG members and independent buyers, respectively; and replacing the equilibrium price in Eq. (5) we obtain seller's profits $\pi_S(s)$. ■

Proof of Proposition 2. Define $x=1-s^2$. We can rewrite the consumer surplus of BG members as

$$CS_{BG}(x) = \frac{x}{[4(1+z)+z^2x]x+(2+zx)\sqrt{x}\sqrt{4(1+z)+z^2x}}, \quad \text{(A2)}$$

from which we obtain

$$\frac{\partial CS_{BG}(x)}{\partial x} = \frac{4(1+z) - \left[2(1+z)+z^2x+z\sqrt{x}\sqrt{4+4z+xz^2}\right]zx}{\sqrt{x}\sqrt{4+4z+xz^2}\,[xz^2\sqrt{x}+4(1+z)\sqrt{x}+(2+xz)\sqrt{4+4z+xz^2}\,]^2}. \quad \text{(A3)}$$

The denominator of Eq. (A3) is always positive. Thus, we can determine the sign of the derivative by inspecting the sign of the numerator. First notice that the numerator is decreasing in *x*. When $x=0$, the numerator is positive, $4(1+z)>0$ and when $x=1$, the numerator becomes $2(2+z)(1+z))(1-z)$ and takes positive value if and only if $z<1$. Therefore:

- If $z<1$, then $\frac{\partial CS_{BG}(x)}{\partial x}$ is always positive along $x \in [0,1]$ and the consumer surplus of BG members is maximized at $x^* = 1$; that is, taking into account that $s=\sqrt{1-x}$, we obtain $s^*=0$.
- If $z>1$, then $\frac{\partial CS_{BG}(x)}{\partial x}=0$ at $x^* = \frac{2}{z(z-1)}\left[\sqrt{2z(1+z)}-(1+z)\right] \in (0,1)$, and $\frac{\partial CS_{BG}(x)}{\partial x}>0$ if and only if $x<x^*$. Taking into account again that $s=\sqrt{1-x}$, we obtain that the consumer surplus of BG members is maximized at $s^* = \left[\frac{z^2+z+2-\sqrt{2z(1+z)}}{z(z-1)}\right]^{1/2}$. Furthermore, since $CS_{BG}(x=0)=0$, it follows that $CS_{BG}(x^*) > CS_{BG}(x=1) > 0$ and $\frac{\partial CS_{BG}(x)}{\partial x}>0$ along $x \in (0,x^*)$. By continuity

there is a value $\bar{x} \in (0, x^*)$ such that $CS_{BG}(x) > CS_{BG}(x=1)$ if and only if $x \in (\bar{x}, 1)$. ■

Proof of Lemma 3. If $CS_{BG}(s) < CS_i^{\mathrm{m}}$, the optimal price p^{m} is that which solves the first-order condition of the problem given in Eq. (19) and the participation constraint is not binding, $\frac{(1-p^{\mathrm{m}})^2}{2} > CS_{BG}(s)$. On the contrary, if $CS_{BG}(s) > CS_i^{\mathrm{m}}$, the participation constraint is binding, and both price p_{BG} and price p_i that solve Eq. (19) are

$$p_{BG} = 1 - \sqrt{2\, CS_{BG}(s)} \tag{A4}$$

and

$$p_i = \frac{1 + z - zs\, p_{BG}}{2 + z - zs}, \tag{A5}$$

respectively. On further inspection, it is evident that whenever $CS_{BG}(s) > CS_i^{\mathrm{m}}$, it holds that $p_{BG} < p^{\mathrm{m}} < p_i$, where $p^{\mathrm{m}} = \frac{1+z}{2+z}$ according to Lemma 1. ■